

به نام خدا  
گزارش تمرین کامپیوتری سوم

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معین کرمی

سوال ۱: Expression manipulation  
(الف)

$$A_1 e^{-\alpha t} u(t) + A_2 e^{-\beta t} \sin(\omega_0 t + \theta) u(t)$$

(ب)

$$\frac{A_1}{s \left( \frac{\alpha}{s} + 1 \right)} + \frac{A_2 (\omega_0 \cos(\theta) + (\beta + s) \sin(\theta))}{\omega_0^2 + (\beta + s)^2}$$

(ج)

$$\frac{A_1 \beta^2 + 2A_1 \beta s + A_1 \omega_0^2 + A_1 s^2 + A_2 \alpha \beta \sin(\theta) + A_2 \alpha \omega_0 \cos(\theta) + A_2 \alpha s \sin(\theta) + A_2 \beta s \sin(\theta) + A_2 \omega_0 s \cos(\theta) + A_2 s^2 \sin(\theta)}{\alpha \beta^2 + 2\alpha \beta s + \alpha \omega_0^2 + \alpha s^2 + \beta^2 s + 2\beta s^2 + \omega_0^2 s + s^3}$$

(د) در این حالت قطب ها به سادگی قابل تشخیص هستند

$$\frac{A_1 \alpha^2 - 2A_1 \alpha \beta + A_1 \beta^2 + A_1 \omega_0^2}{(\alpha + s)(-\alpha + \beta - j\omega_0)(-\alpha + \beta + j\omega_0)} + \frac{j(A_1 \beta^2 + 2A_1 \beta(-\beta + j\omega_0) + A_1 \omega_0^2 + A_1(-\beta + j\omega_0)^2 + A_2 \alpha \beta \sin(\theta) + A_2 \alpha \omega_0 \cos(\theta) + A_2 \alpha(-\beta + j\omega_0) \sin(\theta) + A_2 \beta(-\beta + j\omega_0) \sin(\theta) + A_2 \omega_0(-\beta + j\omega_0) \cos(\theta) + A_2(-\beta + j\omega_0)^2 \sin(\theta))}{2\omega_0(\alpha - \beta + j\omega_0)(\beta - j\omega_0 + s)} + \frac{j(A_1 \beta^2 + 2A_1 \beta(-\beta - j\omega_0) + A_1 \omega_0^2 + A_1(-\beta - j\omega_0)^2 + A_2 \alpha \beta \sin(\theta) + A_2 \alpha \omega_0 \cos(\theta) + A_2 \alpha(-\beta - j\omega_0) \sin(\theta) + A_2 \beta(-\beta - j\omega_0) \sin(\theta) + A_2 \omega_0(-\beta - j\omega_0) \cos(\theta) + A_2(-\beta - j\omega_0)^2 \sin(\theta))}{2\omega_0(\alpha - \beta - j\omega_0)(\beta + j\omega_0 + s)}$$

(ه) قطب ها:

$$s = -\alpha$$

$$s = j\omega_0 - \beta$$

$$s = -j\omega_0 - \beta$$

$$\begin{aligned}
& (A_1 + A_2 \sin(\theta)) \left( s + \frac{2A_1\beta + A_2\alpha \sin(\theta) + A_2\beta \sin(\theta) + A_2\omega_0 \cos(\theta)}{2A_1 + 2A_2 \sin(\theta)} \right. \\
& - \frac{\sqrt{-4(A_1 + A_2 \sin(\theta))(A_1\beta^2 + A_1\omega_0^2 + A_2\alpha\beta \sin(\theta) + A_2\alpha\omega_0 \cos(\theta)) + (2A_1\beta + A_2\alpha \sin(\theta) + A_2\beta \sin(\theta) + A_2\omega_0 \cos(\theta))^2}}{2(A_1 + A_2 \sin(\theta))} \left. \right) \left( s \right. \\
& + \frac{2A_1\beta + A_2\alpha \sin(\theta) + A_2\beta \sin(\theta) + A_2\omega_0 \cos(\theta)}{2A_1 + 2A_2 \sin(\theta)} \\
& + \frac{\sqrt{-4(A_1 + A_2 \sin(\theta))(A_1\beta^2 + A_1\omega_0^2 + A_2\alpha\beta \sin(\theta) + A_2\alpha\omega_0 \cos(\theta)) + (2A_1\beta + A_2\alpha \sin(\theta) + A_2\beta \sin(\theta) + A_2\omega_0 \cos(\theta))^2}}{2(A_1 + A_2 \sin(\theta))} \\
& \left. \right) \\
& \hline
& (\alpha + s)(\beta - j\omega_0 + s)(\beta + j\omega_0 + s)
\end{aligned}$$

سوال ۲: Laplace Analysis  
(ب)

$$\frac{R_2 \left( e^{\frac{i\sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2}}{CLR_2}} - 1 \right) e^{-\frac{i \left( \frac{R_1}{L} + \frac{1}{CR_2} + \frac{\sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2}}{CLR_2} \right)}{2}} u(t)}{\sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2}}$$

(ج)

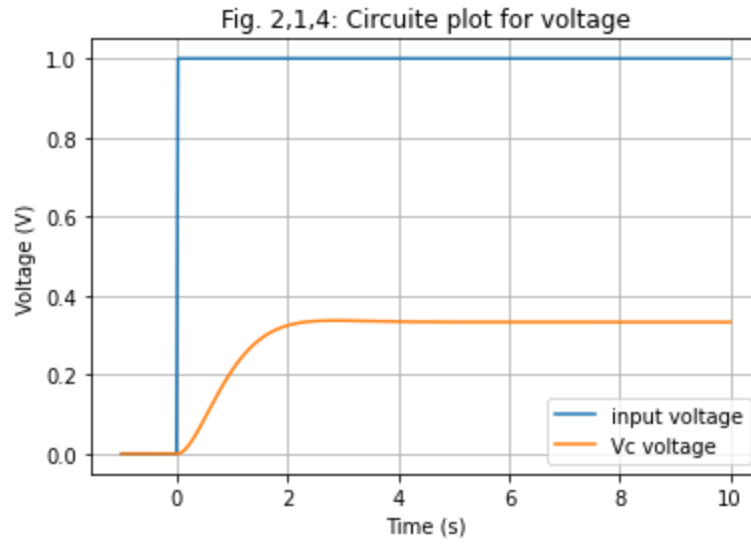
$$\frac{\frac{1}{C} \frac{1}{L}}{\left( s + \frac{CR_1 R_2 + L}{2CLR_2} - \frac{\sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2}}{2CLR_2} \right) \left( s + \frac{CR_1 R_2 + L}{2CLR_2} + \frac{\sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2}}{2CLR_2} \right)}$$

$$\begin{aligned} & 2CLR_2^2 \left( \left( -CR_1 R_2 - L + \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right) \left( CR_1 R_2 + L \right. \right. \\ & + \left. \left. \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right) \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} e^{\frac{i \left( CR_1 R_2 + L + \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right)}{2CLR_2}} \right. \\ & + \left( CR_1 R_2 + L \right. \\ & - \left. \left. \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right)^2 \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} e^{\frac{i \left( CR_1 R_2 + L - \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right)}{2CLR_2}} \right. \\ & + 2 \left( CR_1 R_2 + L - \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right) \left( C^2 R_1^2 R_2^2 - 2CLR_1 R_2 \right. \\ & - \left. \left. 4CLR_2^2 + L^2 \right) e^{\frac{i \left( CR_1 R_2 + L \right)}{CLR_2}} \right) e^{-\frac{i \left( CR_1 R_2 + L \right)}{CLR_2}} u(t) \end{aligned}$$

$$\begin{aligned} & \left( CR_1 R_2 + L - \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right)^2 \left( CR_1 R_2 + L \right. \\ & + \left. \sqrt{C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2} \right) \left( C^2 R_1^2 R_2^2 - 2CLR_1 R_2 - 4CLR_2^2 + L^2 \right) \end{aligned}$$

(د)

$$\frac{\left( 479e^{\frac{31t}{20}} - 31\sqrt{479} \sin \left( \frac{\sqrt{479}t}{20} \right) - 479 \cos \left( \frac{\sqrt{479}t}{20} \right) \right) e^{-\frac{31t}{20}} u(t)}{1437}$$



Laplace Transfoorm:

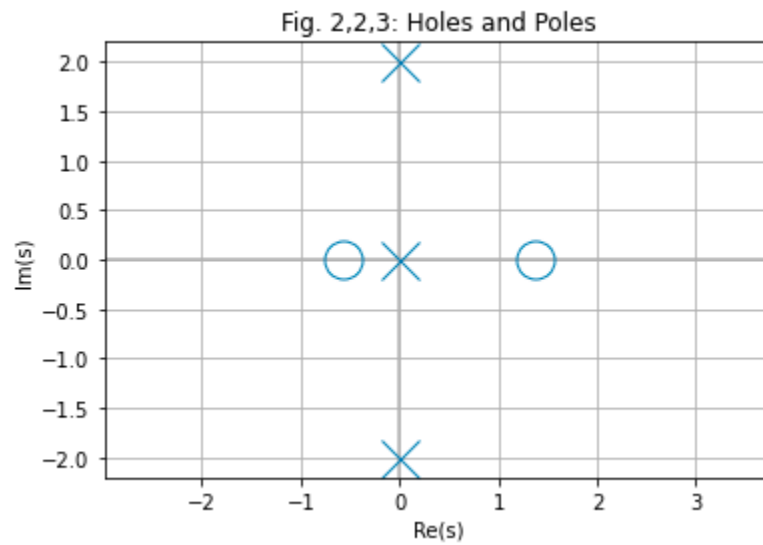
(الف)

$$\frac{f_0^2}{2s} - 2f_0 + \frac{s \left( \frac{f_0^2}{2} - 6f_0 - 2 \right)}{s^2 + 4} + 4 + \frac{2 \left( \frac{3f_0^2}{2} + 2f_0 - 6 \right)}{s^2 + 4}$$

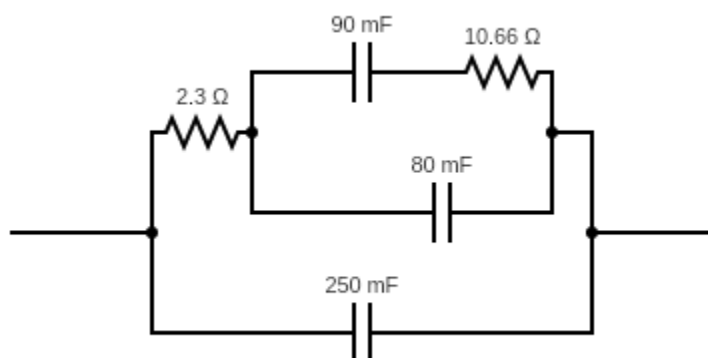
(ب)

$$-\frac{12s}{s^2 + 4} + \frac{8}{s^2 + 4} + \frac{2}{s}$$

(ج)



سوال ۳ : Networks  
(الف)



(ب)

Fig. 3,2: Impedance of Circuite

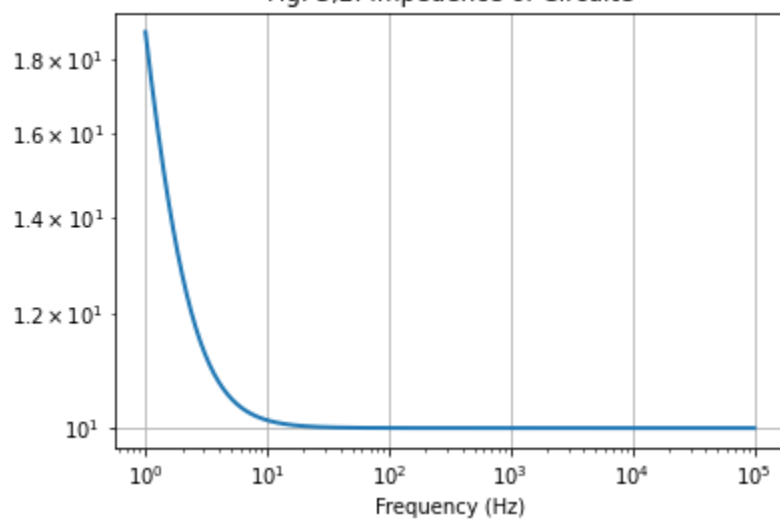


Fig. 3,3: Current

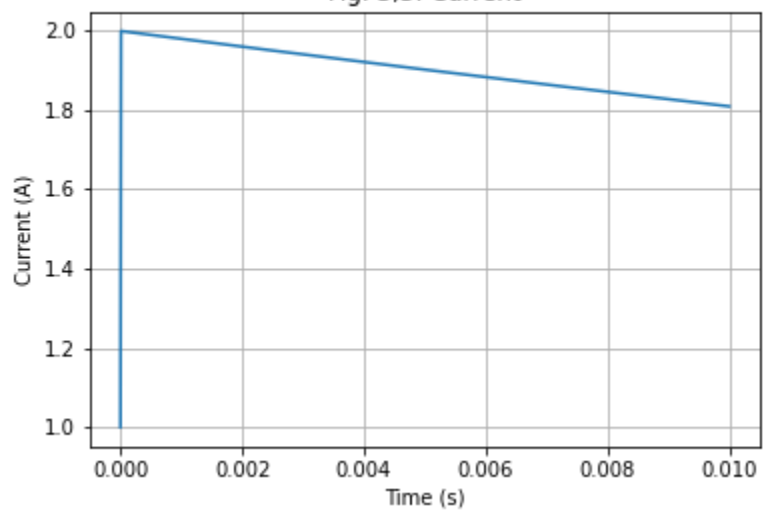
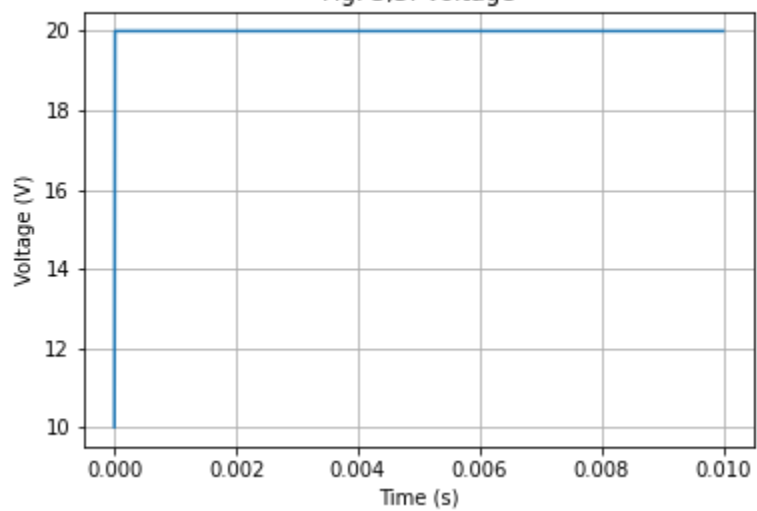


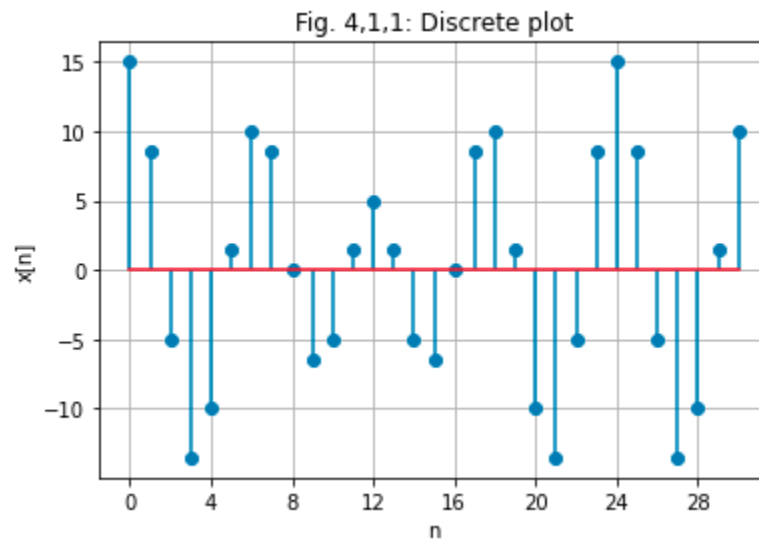
Fig. 3,3: Voltage



## سوال ۴: Discrete time signals

Discrete analysis:

(الف) دوره تناوب = ۲۴



(ب)

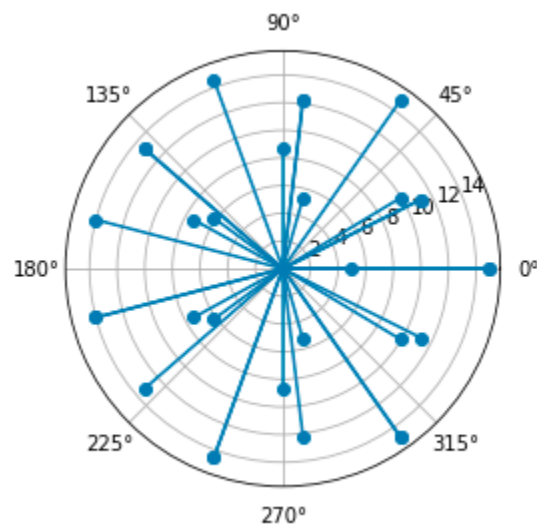


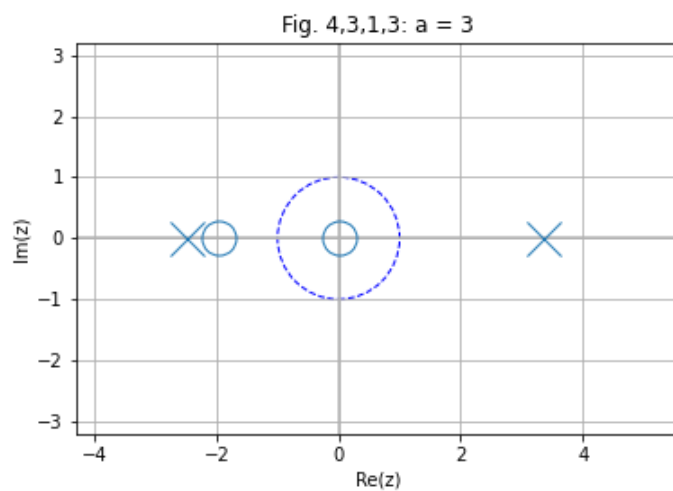
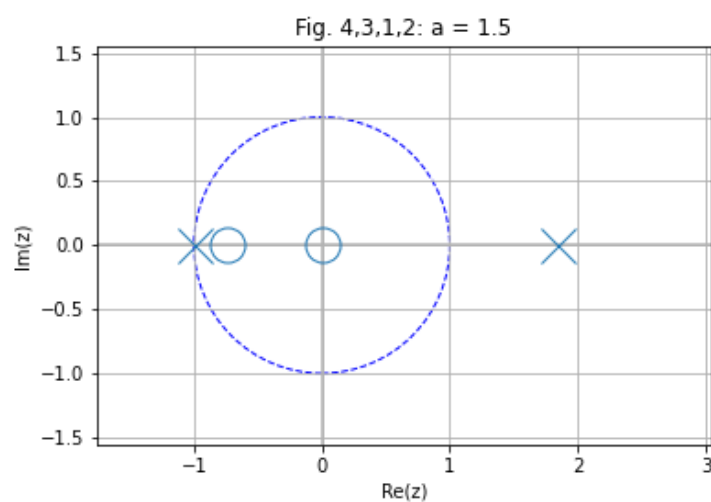
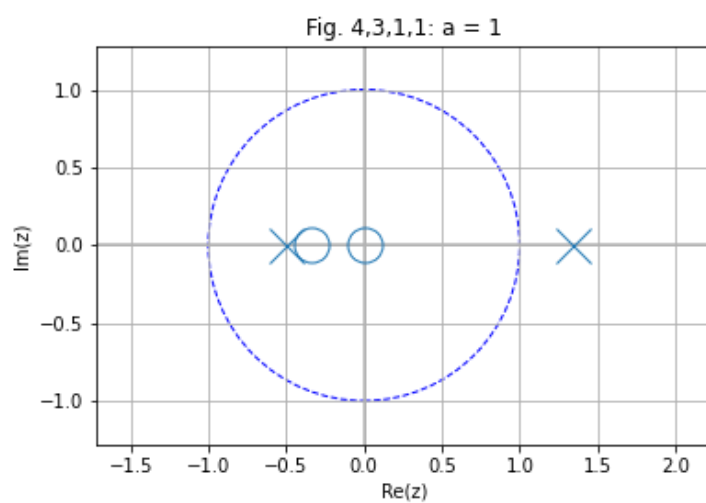
Fig. 4,1,2: Polar plot

Sequences:

$$X_4 = \{3+2j, -2+j, -1-6j, 6-7j, 7-2j, 2-3j\}$$

## Discrete Transforms:

(الف)





(ب) (۱)

$$\frac{az}{(a-z)^2}$$

(۲)

$$aa^{n-1}nu\left[ n\right]$$

(۳)

$$\frac{-Na^N+\left( Naa^N-aa^N+a\right) e^{-\frac{2j\pi k}{N}}}{\left( -ae^{-\frac{2j\pi k}{N}}+1\right) ^2}$$

(۴)

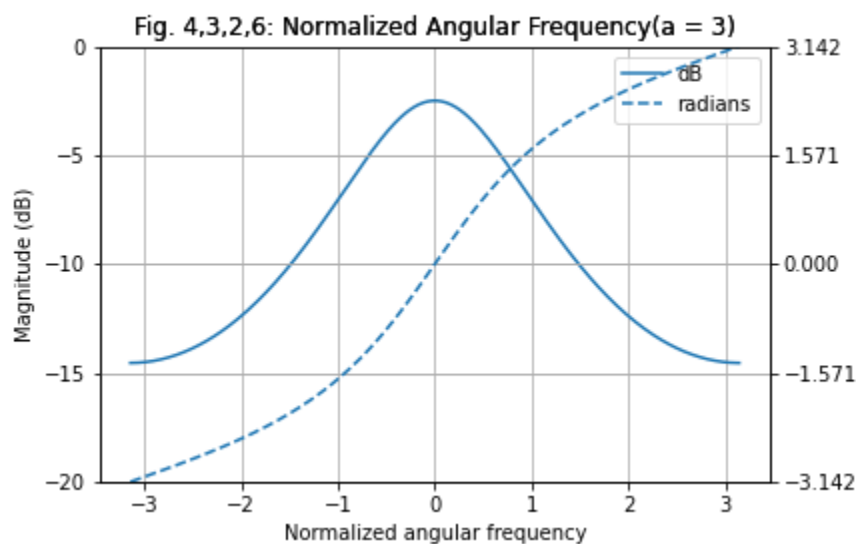
$$\frac{ae^{2j\pi \Delta f}}{a^2-2ae^{2j\pi \Delta f}+e^{4j\pi \Delta f}}$$

(۵)

$$\frac{ae^{2j\pi F}}{a^2-2ae^{2j\pi F}+e^{4j\pi F}}$$

$$\frac{ae^{j\Omega}}{a^2-2ae^{j\Omega}+e^{2j\Omega}}$$

(۶)



سوال ۵: Difference Equation  
(الف)

$$y(n) = ax(n) + bx(n-1) - cy(n-1) - dx(n-2)$$

(ب)

$$\frac{az^2 + bz - d}{z(c + z)}$$

(ج)

$$(-c)^n \left( a - \frac{b}{c} - \frac{d}{c^2} \right) - \frac{d\delta[n-1]}{c} + \frac{(bc+d)\delta[n]}{c^2} \text{ for } n \geq 0$$

(د)

$$y(n) = x(n) + x(n-1) - 2y(n-2) + 3y(n-1)$$

(هـ)

$$y(n) = x(n) + x(n-1) - 2y(n-2) + 3y(n-1)$$

(و)

Response = {0, 3, 15, 51}